CS 415 Home Work 1 Fall 2017

September 9, 2017

`This HW will be done in pairs. Each team will have a single submission. Make sure to include both names in the submission. This HW will weigh 3 points.`

PROBLEM 1 30 points

Recall that for functions $f, g : N \to A$, we say that $f = O(g)$ if there exists a constant $c > 0$ such that $f(n) \leq c\, g(n)$ for all n. We say that $f = \Omega(g)$ if $f(n) \geq c\, g(n)$ for all n and $f = \Theta(g)$ if $f = O(g)$ and $f = \Omega(g)$.

Shown below is a list of functions that map from $N \to N$.

$$n^{0.1} \qquad \frac{n}{log_2\ n} \qquad n + 2\sqrt{n} + 100\ log\ n \qquad 3^{(log_2\ n)} \qquad n\ log_2\ n \qquad log_2(n!)$$

For each pair $(f,\ g)$ of the above functions, determine if $f(n) = O(g(n))$, $f(n) = \Omega(g(n))$, $f(n) = \Theta(g(n))$ or none of the above. Create a table to exhibit your result. For each pair of functions f, g, compute the limit $lim_{n\to\infty}\frac{f(n)}{g(n)}$. If the limit is 0, then conclude that $f = O(g)$; if it is some finite $c > 0$, then conclude that $f = \Theta(g)$; if the limit is ∞, then conclude that $f = \Omega(g)$. (You can assume basic facts such as:

$$\lim_{n\to\infty} \frac{n^t}{(log\ n)^k} = \infty.$$

for any real numbers t, k where $t > 0$.)

PROBLEM 2 15 points

Exercise 1.21

PROBLEM 3 15 points

Exercise 1.27

PROBLEM 4 15 points

If n is an odd number, what is the inverse of n mod $(n+2)$?